



ROSNEFT

V CONFERENCE
"UPSTREAM TECHNOLOGIES"
2019

Development of High-Tech Well Logging Services

Moscow

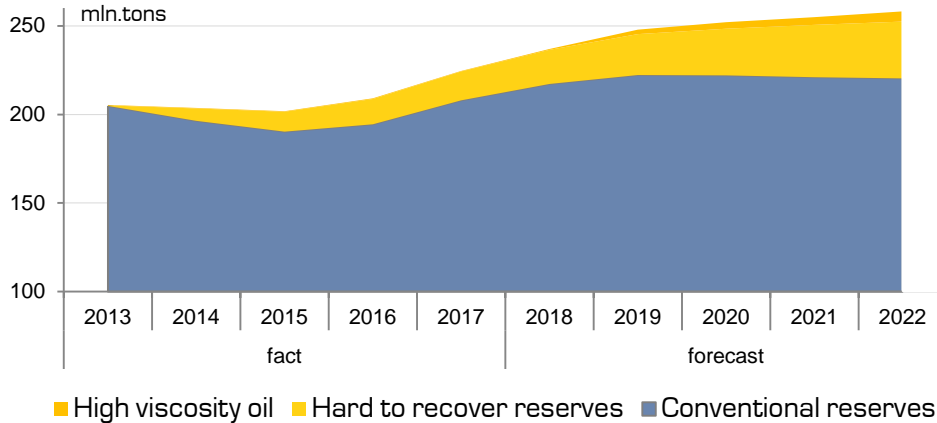
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Increasing role of high-tech well logging

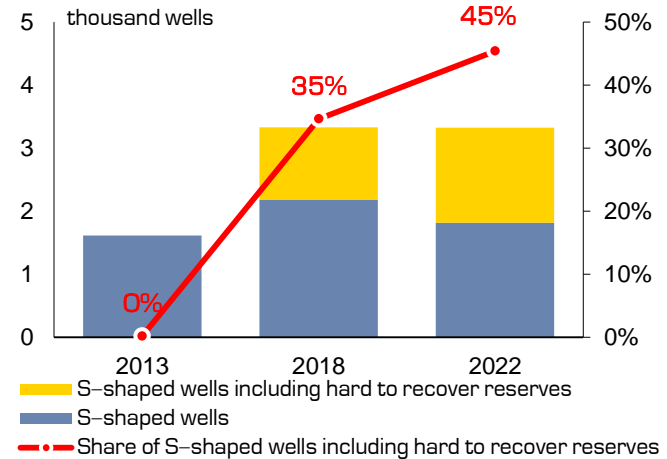


- ▶ The structure of reserves and wellstock **determines the need to improve** the logging technologies (due to increase in hard-to-recover reserves, horizontal wells, etc.)

Oil production profile of Rosneft



Change of share of new wells and horizontal producing wells in challenged reserves



- ▶ The achievement of goals laid down in Rosneft–2022 Strategy is supported by the Development Strategy of high-tech well logging, which **was adopted at the first Technological Council** of the Company with the participation of the top managers of leading global companies in the field of oil and gas production, science and technology.

Fulfilling geological tasks using Russian logging equipment: current status and objectives



► Current status:

High-tech logging tasks are mainly fulfilled with the use of foreign made equipment or by integrating data from standard logging, core and fluid studies

► Goal:

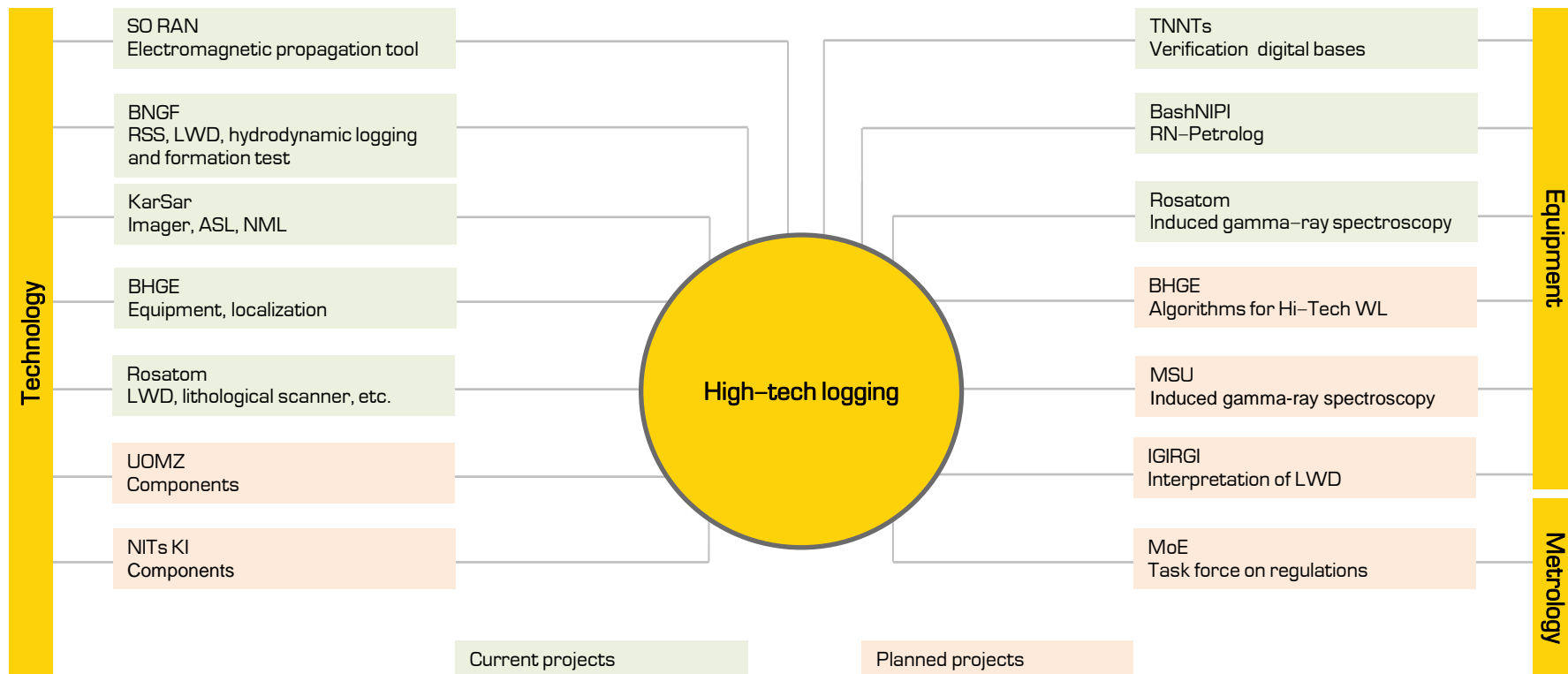
Development of domestic high-tech logging services, which will help to increase resilience of the company to unfavorable external environment.

Geologic Objectives incl. high-tech ones	Technological objectives	2019	2022+
Determining lithology, structural, reservoir and mineralogical properties, including: – in unconventional reservoirs (in thin bed and fractured deposits, etc.) – with account for anisotropy in horizontal wells	Reserves		
	Porosity, saturation, thickness		
Formation testing and sampling, including: – interval testing – while drilling	Productivity		
	Saturation, reservoir pressure		
Geosteering including: – including determination of reservoir and lithology properties while drilling	Flow rate		
	Effective length		

Key components and projects map for high-tech logging services development



- ▶ **An integrated approach** is implemented covering several related areas involving leading industrial and R&D centers going outside the traditional oil and gas scope



Requirement and development priorities of well logging services types



- ▶ The requirement and **development priorities** of high-tech well logging are based on:
 - Current and potential demand
 - Degree of readiness of the equipment for implementation
 - Technological level of Russian equipment

	LWD	Rotor-steerable system	Cartography borders	Com channels	PLT in HW	Downhole tractor	Hydrodynamic logging and formation test	NML	Induced gamma-ray spectroscopy	Electronic micro scanner	Cross-dipole acoustic log	3D electromagnetic logging
Current need, jobs/year	> 1000	> 1000	> 100	> 1000	> 200	> 200	> 100	> 150	> 120	> 200	> 250	> 60
Potential need (mid-term)	2200	2200	220	2200	400	400	350	350	150	350	350	70
Readiness for implementation	Pilot	Development	Development	Pilot	Pilot	Development	Development	Pilot	Pilot	Pilot	Pilot	Pilot
Technological level of Russian analogs	Low	Low	Low	Middle	Middle	Low	Middle	Middle	High	High	High	High
Priority	High	High	High	High	High	High	Middle	Middle	Middle	Low	Low	Lo

The indicated priority determines plans for the implementation of Target Innovation Projects and the program of pilot dev./testing



- ▶ High-tech logging **requires methodology base development** and creation of logging interpretation application complex

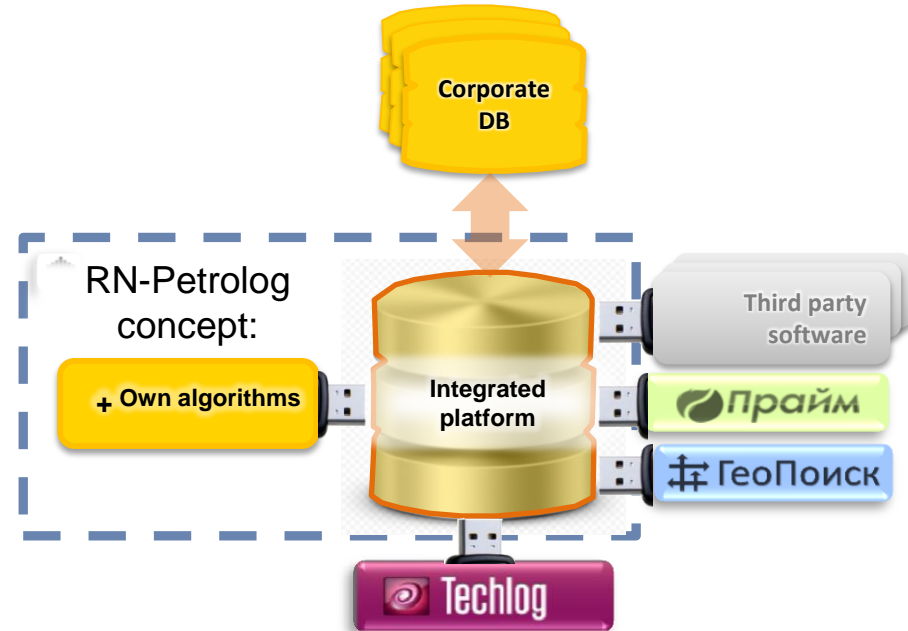
Current status:

- ▶ High-tech logging has a **foreign** software interpretation
- ▶ Domestic SOFTWARE allows to interpret **standard** logging
- ▶ Poor software integration

RN-Petrolog features:

- ▶ **Integration** with corporate database and petrophysical complexes
- ▶ Previously absent in domestic software:
 - Multi-well processing technology
 - Logging in horizontal wells
 - Special modules for high-tech logging service
 - Implementation of BigData analysis technologies

RN-Petrolog concept:

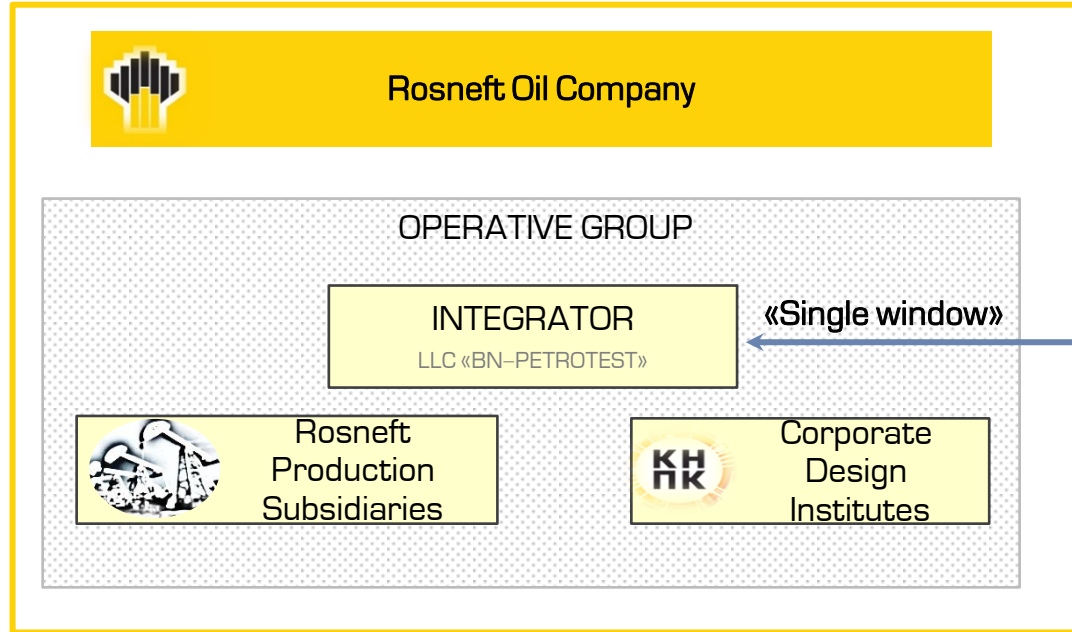


Scheme of interaction for the development of high-tech logging tools



CONTRACTORS

Logging Service Companies



HOME-COUNTRY PARTNERS

Equipment development and methodological support



Scientific Production Enterprise of Geophysical Equipment «Looch»



ROSATOM



Russian Academy of Sciences, higher Educational Establishments, Research Organizations

Other potential partners

- **Set up a single window** for interaction with home-country technology partners represented by Bashneft-PEROTEST for aggregation research and technical potential of domestic manufactures of equipment and coordination pilot testing
- The **mechanism of interaction** was formed among the divisions of the Company when following-up pilot operations and forming plans of works – "working group" as a set of technical, petrophysical and administrative competences

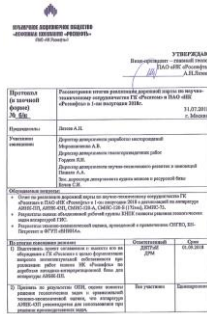
Technology testing (some examples)



AINK-43P tool

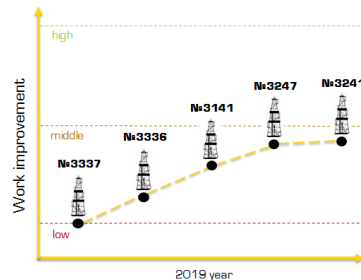
Determination of water-saturated porosity and saturation pattern

- **Features:** great accuracy (increased generator frequency, less dead time), longer work resource
- **Status:**
 - Pilot testing completed on 15 wells
 - Recommended to use
 - Positive conclusion is received from Russian GKZ



SMIS-172B tool Well logging while drilling

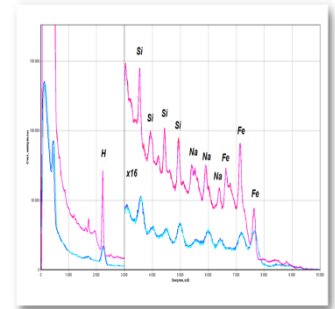
- **Features:** presence of the induced gamma-ray spectroscopy module to determine the elemental composition while drilling
- **Status:**
 - Pilot testing completed on 11 wells
 - Constructive and methodological upgrade underway



AINK-PL tool

Rocks elementary composition determination

- **Features:** it's design is as good and in some respects even better than the similar foreign products
- **Status:**
 - Pilot testing completed on 8 wells
 - Carbon/oxygen logging functionality
 - Technology development for expanded elemental composition



«Cheetah» system Seismic surveys

- **Features:** low cost and eco-safe seismic technology that ensures a survey density exceeding the usual one from 5 to 10 times
- **Status:**
 - Tested in West Siberia and Middle East
 - Preparation for implementation





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